

NOVEMBER/DECEMBER 2023

23PECM14B — OPERATIONS RESEARCH

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. List out the merits of Operation Research.
2. What are the basic assumptions of Linear Programming Problem?
3. What is Transportation Problem?
4. Give two applications of Assignment Problem.
5. Define a game.
6. What are the assumptions of sequencing?
7. When should the replacement be done?
8. List out the objectives of PERT.
9. What do you mean by queue?
10. Define idle time costs.

Job	1	2	3	4	5	6
Machine I	5	9	4	7	8	6
Machine II	7	4	8	3	9	5

Find the sequence of job that minimizes the total elapsed time to complete the jobs.

Or

- (b) In a game of matching coins with two players, suppose A wins one unit of value when there are two heads. Win nothing when there are two tails and loses $\frac{1}{2}$ units of value when there are one head and one tail. Determine the pay-off matrix, the best strategies for each player and the value of the game to A.
14. (a) XYZ manufacturing company using a machine whose purchase price Rs 65,000. The installation charges amount to Rs 18,000 and the machine has a scarp value of only 8,000 because the firm has a monopoly of this type of work. The maintenance cost in various years is given in the following table:

19. A fleet owner has three trucks, two of which are two years old and third one is one year old. The annual cost for a smaller truck is Rs. 68,000; Rs. 64,500; Rs 64,000; 64,500 and Rs. 66,400 during first, second, third, fourth and fifth year respectively. He is considering a new type of large truck with 50% more capacity than one of the old ones at a purchase price of Rs. 4,00,000. The estimation of running cost and resale price for the new truck is as given below:

Year	Running Cost	Resale Price
1	24,000	3,00,000
2	28,000	2,76,000
3	32,000,	2,52,000
4	40,000	2,28,000
5	48,000	2,04,000
6	56,000	1,80,000
7	68,000	1,50,000
8	84,000	1,00,000

Assuming that the loss of flexibility due to fewer trucks is of no importance and he continues to have sufficient work for these three trucks, what should be his replacement policy?

17. A department head has four subordinates and four tasks to be performed. The subordinates differ in efficiency and the task differs in their intrinsic difficulty. His estimate of the time each man would take to perform each task is given in the matrix below:

Task	Men			
	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

How should the tasks be allocated one to a man, so as to minimize the total man hour.

18. Solve the following game:

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Year	1	2	3	4	5
Maintenance cost (Rs.)	1,250	3,750	5,000	7,500	10,500
Year	6	7	8	9	
Maintenance cost (Rs.)	14,500	20,000	24,000	30,000	



Determine after how many years the machine should be replaced, assuming that the machine replacement can be done only at the year ends.

Or

- (b) Construct PERT network for the following project and determine the Critical Path and project duration

Activity	Duration in days	Immediate Predecessors
A	4	None
B	1	None
C	1	A
D	1	B
E	6	C

Activity	Duration in days	Immediate Predecessors
F	8	E
G	2	F
H	4	F
I	1	G
J	5	H,I
K	5	D,G
L	2	K

15. (a) A large service station has a store room from where the service machines take the parts for the job they work upon. The machines wait in the line to get the parts that they need. The store is manned by one attendant who can, on an average, attend 7 mechanics per hour. It is observed that, on an average the mechanics average arrival rate at the store room is 5 per hour. Assuming that the pattern of mechanic's arrivals is Poisson distributed and the servicing time is exponentially distributed, determine.

- (i) The expected number of mechanics in the system that is those waiting in line and being serviced by the attendant
- (ii) The expected number of machines waiting in the queue
- (iii) The expected time that a machine has to spend in the queue
- (iv) The expected time that a mechanic spend in the system that is waiting in the queue and getting service.

Or

- (b) Explain the steps in Decision Tree Analysis.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Solve the following LPP Using simplex method

$$\text{Max } Z = 15x_1 + 6x_2 + 9x_3 + 2x_4$$

$$\text{Subject to } 2x_1 + x_2 + 5x_3 + 6x_4 \leq 20$$

$$3x_1 + x_2 + 3x_3 + 25x_4 \leq 24$$

$$7x_1 + x_4 \leq 70$$

$$x_1, x_2, x_3, x_4 \geq 0$$